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Sweet potato scurf, black rot, and stem rot are three serious field diseases of the sweet potato which, although they differ in cause, have much in common. All are caused by fungi which are capable of living in the soil for several years after sweet potatoes have been grown therein. These disease producing fungi may be carried to the seedbed by the use of diseased seed potatoes and likewise may be spread from field to field by the use of diseased sprouts. Because of the similarities in these diseases, certain of the measures which provide relief from their attacks are similar.

Sweet Potato Scurf

Sweet potato scurf annually exacts a heavy toll from the value of the New Jersey sweet potato crop. This reduction in crop value is not caused by a reduction in yields but rather by the unsightly appearance and poor keeping qualities of the diseased potatoes.

Scurf may occur as small, circular, brownish or blackish spots on all underground parts of the sweet potato plant. When there are many such small spots, they may coalesce to form a uniform brownish patch, which, in severe cases, may involve the whole potato. On red-skinned varieties these infected areas become almost black. Severely affected potatoes may become more or less prominently cracked. The disease is wholly superficial, but the skin is injured enough to allow moisture to escape, which causes the potato to shrivel excessively in storage.

The fungus which is responsible for the production of this disease lives through the winter on diseased potatoes and on decaying plant parts in the soil either in the seed-bed or in the field. When diseased potatoes are placed in the seed-bed, the fungus spreads from the potato to the sprouts. In the field the fungus grows down these sprouts to the developing sweet potatoes. Observations made over a number of years in New Jersey, suggest that a large portion of the scurf occurring in the field has its origin in diseased seed potatoes and sprouts. Sprouts or potatoes may also become infected by the scurf organism living on organic matter in the soil.

From a consideration of the life cycle of the fungus responsible for scurf, several measures might be expected to be of value in the control of this disease.

As has been pointed out, infection in the field may be caused by the use of diseased sprouts, or by setting healthy sprouts in an infested field. As the sprouts may become diseased from the use of diseased potatoes for bedding purposes, or from the seedbed, it is important that these sources of infection be eliminated. Because it is impossible to be sure by a close inspection that sweet potatoes are entirely free from scurf or that they do not contain spores of the scurf organism on their surfaces, it is recommended that potatoes that appear to be as free from scurf as possible be used for bedding, and that these potatoes be dipped in a suitable organic mercury fungicide. Treated potatoes should be bedded in sand in which sweet potatoes have never been grown. As a final precaution, the sprouts should be dipped in a satisfactory mercurial before they are set in the field.

Although these precautions will usually ensure a crop of sweets which is practically free from scurf, they are not always effective. This is true chiefly because seed and sprout treatments can not be expected to have a marked effect on the organism living in the soil in the field. Where infection from the soil is common, a long rotation should be of value. Where it is desirable to grow sweets year after year in the same soil, however, one should abstain from using manure or other sources of plant organic matter since scurf is usually more severe in soils to which organic matter has recently been added.

Work conducted in New Jersey by Dr. R. F. Poole showed that the amount of scurf caused by field infection may be reduced by broadcasting sulfur on the surface of the soil about one month before setting the crop. Since the use of excessive amounts of sulfur may cause a considerable reduction in yields, it should not be used on a soil unless advised by a qualified person who has investigated such points as soil pH, texture of soil, and disease records.

It has been shown that scurf gradually increases in severity during the fall months. This being true, potatoes from the areas most affected should be harvested first whereas the areas where scurf is usually not a problem may be left until a later date.

Black Rot

The losses caused by black rot are not nearly so great as they were a decade or more ago. In 1922 Dr. Poole reported that black rot was not only one of the most common diseases of the sweet potato in New Jersey, but also one of the most destructive. He further states, "It has caused 75 per cent loss in some storage houses this winter." During the last few years very few cases of black rot have been brought to our attention. This reduction in the severity of black rot may be explained on the basis of general adoption of the control measures discussed in the following paragraphs.

Black rot is a fungus disease of sweet potatoes which affects the potatoes while in the field or in storage. It may also affect the sprouts in the seedbeds or plants in the field.

All the underground portions of the plant may be attacked, the most conspicuous lesions being on the potatoes where dark, circular spots of various sizes may be observed. When the disease is not followed by other rot-producing organisms, the lesions usually remain shallow, averaging about ¼ inch in depth.

In the seedbed, black lesions usually located at the base of the sprouts and varying in size, may occur on the young sprouts. Such cankers may cause dwarfing and yellowing of the foliage and eventually the death of the plant. The canker involves the underground portions of the plant but may extend upward until an inch or more of the stem above ground is included. Wilting frequently accompanies severe root infections. Plant symptoms in the field are very similar to those on the sprouts.

The fungus which is responsible for the production of black rot lives over winter in storage houses on diseased potatoes. It not only lives on stored potatoes but may spread to other potatoes sufficient to become a major storage problem. The organism may live on susceptible weed hosts, such as the wild morning glory and, according to Dr. Poole spores of the black rot organism may also remain in the soil for a few years to infect future crops.

From the foregoing discussion it is evident that it is of utmost importance that the sprouts which are set in the field be free from black rot. Such sprouts can be obtained if rigid seed selection, seed and sprout mercurial treatments, and seedbed sanitation be practiced. It should also be stated that the seed should be carefully inspected for black rot just before bedding in the spring, since potatoes which go into storage free from the disease may contract the malady while in storage.

Treated sweet potatoes should be bedded in sand free from the black rot organism. Where manure is used as the source of heat in the seedbed it should be devoid of sweet potato refuse.

In fields where black rot is a perennial problem, crop rotation and eradication of wild morning glory should be practiced.

Stem Rot

Stem rot has long been one of the most destructive diseases affecting sweet potatoes in New Jersey. In 1922 Dr. Poole reported that an estimated average of 23 per cent of the New Jersey sweet potato crop was destroyed annually by this disease. Although this percentage is too high to represent present day conditions, losses from stem rot are still considerable in some localities. Perhaps one would not be far wrong to estimate losses caused by stem rot over a period of years to be equivalent to all other field diseases

of the sweet potato combined. Such losses are caused almost entirely by yield decreases.

The fungi that cause stem rot enter the sweet potato plants through the roots and may then grow extensively in the water-conducting tissues of the roots and stems. The symptoms of this disease are manifested at first by a slightly yellowish tinge of the foliage. This slight off color is soon followed by a more pronounced yellowing and dropping of the older leaves, and finally by a wilting and death of the entire plant. Wilting is less severe in wet seasons than in dry seasons. If the stem of a diseased plant is split near the base it will be found to have numerous dark streaks internally instead of the uniform light color characteristic of healthy vines. This darkening may also extend into the potatoes.

The organisms causing stem rot live over winter in the diseased potatoes and in the soil. When diseased potatoes are bedded, the resulting diseased sprouts may or may not show any visible symptoms of the disease. Such diseased sprouts, when planted in the field, introduce the stem rot fungi into the soil, where they may live for long periods of time.

To date, the most effective control measures for stem rot consist of using disease-free potatoes for bedding purposes, bed such potatoes in sand which is free from the stem rot organisms, dip the roots of the resulting sprouts in a satisfactory mercurial, and avoid injuring the plant roots by the improper application of fertilizers. Disease-free potatoes may be obtained by selecting them from healthy hills. Such healthy hills may be located by splitting the stems before the vines are frozen and selecting seed stocks only from plants where stems show no internal darkening.

Field infection can be prevented or delayed by the sprout dip treatment. A treatment of this type protects the sprouts while the wounds, caused by pulling, are healing over. In fields where stem rot is a perennial problem, a long rotation is the only known method which will appreciably reduce the severity of the disease.

Control — General

In the foregoing discussion of the control of scurf, black rot, and stem rot, it is recommended, in all cases, that disease-free sprouts be set in the field. Such disease-free sprouts can best be produced by bedding treated seed in sand which is free from the disease-producing organisms concerned. As a further aid the resulting sprouts should be dipped in a suitable mercurial before setting them in the field.

Seed Treatment.—Of the various materials that have been used for seed potato dip treatments in New Jersey, an organic mercurial 1-8 has received the most general use. This treatment provides effective control and is also comparatively safe for use.

Sprout Treatments.—Experiments have demonstrated that organic mercurials are good not only for seed treatments, but for sprout treatments as well. Although the organic mercurial treatment usually does not retard growth for more than two or three days, it may, under some conditions, produce considerable injury to the young plants. Where conditions favor rapid drying of the plants, such as where they are set in unusually dry soil, and especially if the relative humidity of the atmosphere is also low, injury is likely to be extreme. This is especially true if the plants are succulent or weak from any cause. Injury is also apt to be exaggerated if the weather is too cool to allow the sprouts to start well. Under unfavorable conditions one might well question the advisability of using a weakened mercurial solution (1-12½) instead of the regular strength (1-10) providing, of course, that adequate precautions have been taken in the plant bed.

It is a common practice in New Jersey to pull and treat the sprouts before starting to plant. Where this procedure is followed, enough plants are pulled to keep the planter busy for several hours. Such plants, between the time of treating and planting, are packed tightly in baskets and kept moist with wet burlap bags. In experiments designed to test the advisability of holding treated sprouts for several hours before setting in the field, it has been found that significantly less injury is produced if the sprouts are treated just before planting instead of where they are treated and then held for several hours. This slightly modified procedure reduces the likelihood of injury to the sprouts and requires very little extra time. Where this procedure is followed the sprouts are treated in the field just before planting. Sprouts treated in this manner should not be allowed to dry out before they are set in the field.

Seedbed Sterilization.—The importance of bedding sweet potatoes in sand which is free from disease-producing organisms has been referred to on several occasions. Where this is not done the control program may be seriously weakened. To guard against this danger it is advised that the sand in the plant beds be replaced annually by clean sand that has not been used previously in sweet potato culture. Before clean sand is placed in the beds, as a precaution, it is wise to scrub all solid parts of the bed thoroughly with a solution of formaldehyde, 1 pint in 6 gallons of water, or with a solution of copper sulfate (bluestone) 1 pound in 5 gallons of water. Any sand in the corners or on the bottom of the beds that is not cleaned out should be thoroughly soaked with this solution. This practice is of particular value if diseased sprouts were produced in the bed the previous year.

Where the same sand is used for more than one season it should be properly sterilized in order to kill any germs which may be present.

Sand sterilization can be done effectively with steam or with chemicals. Where steam is not available, formaldehyde has given excellent results.

Liquid formaldehyde is used for soil sterilization. The liquid is usually

sold under the trade name of Formalin or Formaldehyde and usually contains approximately 37 per cent formaldehyde gas in water solution. This commercial product should be diluted with water before it is applied to the soil.

The sand should be thoroughly saturated with a solution of formaldehyde, at a strength of 1 pint of the commercial liquid in 12½ gallons of water. This material should be slowly and uniformly sprinkled on the sand, at the rate of 1 gallon to each square foot of bed surface, care being taken that the material soaks into the soil uniformly. After the application is completed the sand should be covered with paper or burlap for a period of 12 to 24 hours. A more convenient, but slightly less effective method, is to apply the same amount of formaldehyde with less water (1 pint to 6 gallons at ½ gallon per square foot or 1 pint to 3 gallons at ¼ gallon per square foot of bed surface) and wash it in with clear water. When disinfecting the soil in the winter perhaps a formaldehyde solution of higher concentration may be desirable, as it may be difficult to dry the sand sufficiently for use where large amounts of water are used. Where this treatment is not made until nearly planting time, care must be taken to be sure that no odors of formaldehyde can be detected from the soil before bedding the sweet potatoes, otherwise serious injury may result.